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HydroLink SL Series
Wireless Data Transceivers

Quick-Start Guide

and

User's Manual

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QUICK START GUIDE FOR THE OCEANSCIENCE RIVERBOAT
Using an RD Instruments WorkHorse series ADCP

If this is the first time you have used your Oceanscience Riverboat system we highly recommend you familiarize yourself with the setup procedures prior to field deployment. Testing in the office can save valuable field time. While testing the transceivers in close proximity it is advisable to unscrew the MaxRad antenna from the boat. This avoids the possibility of over-modulation. Once you've established communications in the lab you should reattach the MaxRad antenna and test at a greater separation.

The most important phase of setup is configuring your ADCP so that it will communicate through the modems. This is done by setting the baud rate of the ADCP to 115,200 bps. This matches the default baud rate of your HydroLink SL. (See section 1, Configuring the ADCP, for details on how to do this).

The next step is to install the ADCP in the Riverboat (see separate Riverboat Assembly Instructions).

Install the Remote transceiver in the Riverboat (see section 3, Remote transceiver setup).

Establish communications between your transceivers by completing section 4, Base Transceiver Setup and System Power up.

Confirm ADCP data transmission through the transceivers (section 5, WinRiver Setup).

If you are receiving data from the ADCP you can simply turn off the Riverboat toggle and disconnect power to your Base transceiver. Once in the field, you can apply power and should be ready to begin your discharge measurements.

Overview

Thank you for purchasing an Oceanscience Group product. It is our intention to provide our customers with the latest technologies, the highest quality manufacturing and the most efficient customer service and support. This manual outlines the use of HydroLink SL series Wireless Data Transceivers with specific references to their use with The Oceanscience Riverboat for ADCP deployment.

Simply put, the HydroLink transceivers eliminate the need for data transmission cables. **Please note: The transceivers have a fixed data transmission rate (baud rate). In order to send data through them, your instruments and laptop or other receiving device must be set to the same baud rates as those installed in the transceivers. The default baud rate for your SL series transceivers is 115,200. This rate is optimized and cannot be altered unless you have purchased an SL programming cable and guide, or you return the transceivers to The Oceanscience Group.** The HydroLink SL Wireless Data Transceivers are pre-configured for high-speed data communication and each pair is programmed to communicate only with one another.

Configuring the ADCP: Baud Rate of 115,200 bps

The following procedure explains how to set the baud rate and save it in the ADCP. This procedure assumes that you will be using the program BBTalk supplied by RD Instruments.

With ADCP connected directly to your PC, begin by configuring the baud rate of the ADCP to match the baud rate of the radio. If these do not match, the ADCP cannot communicate through the transceiver.

1. Connect the ADCP to the computer and apply power (see the appropriate ADCP User's Guide).
2. Start the *BBTalk* program and establish communications with the ADCP by choosing *Workhorse, the appropriate Com*, and *Next*. If this is the first time using the Workhorse choose *Next* at the "Port Settings" window. When the "Options" window appears place a check in the boxes labeled *Send CK on baud rate change*, and *Use Software Break*.
3. Wake up the Workhorse by sending a break signal with the blue (===) button.
4. Send the command CR1 to enter setup.
5. Find the baud rate on the table below that matches the baud rate of your Oceanscience HydroLink transceivers (115,200 bps). Send the corresponding CB command.

Table 1: Baud Rate

Baud Rate	CB Command
4800	CB311
9600 (default)	CB411
19200	CB511
38400	CB611
57600	CB711
115200	CB811

6. In *BBTalk*, press *F5* and change the settings to match your CB command settings. Press *OK* to exit the communication setup screen.

7. Send the command CK to save the new baud rate setting (this may not be necessary if there is a check in the box "send CK on baud rate change").
8. Click *File*, *Close* to exit the terminal window.

The ADCP is now set for the new baud rate. (The baud rate will stay at these settings until you changed back with the CB-command.)

Remote Transceiver Setup

The ADCP is now ready to communicate with the laptop through the HydroLink transceivers. Place the remote transceiver in the Riverboat as shown in figure 1. Attach the data cable as shown. (The 8-pin data cable connector is *keyed* and will only attach to the transceiver when oriented correctly.) **Do not force the connectors.** Next , attach the SMA antenna connector. Slide the transceiver into the compartment as shown in figure 2. Install the foam block behind the battery (see Fig. 4) and install and connect the battery (Fig. 3). Place the remaining foam blocks (arrangement shown in figure 4). The foam will hold battery and transceiver snug in the compartment during deployment.

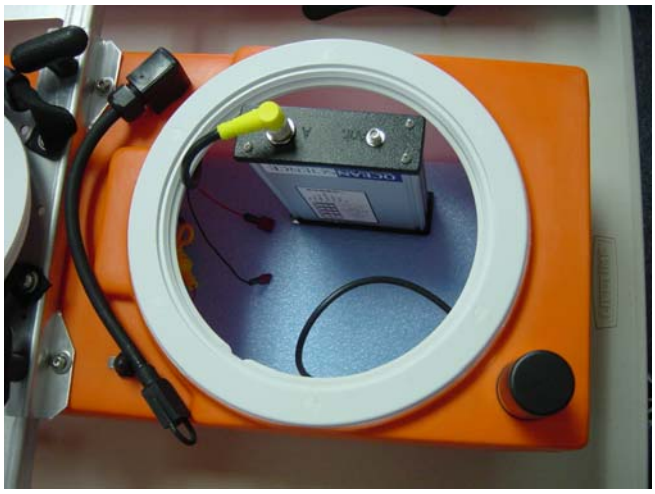

Figure 1.

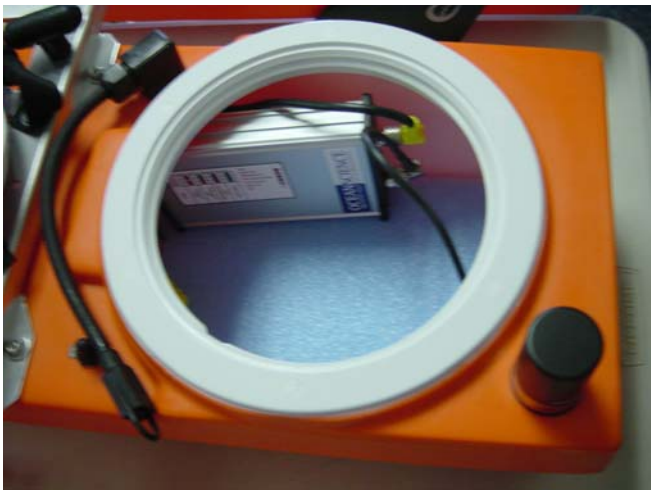

Figure 2.

Figure 3.

Figure 4.

Base Transceiver Setup and System Power up

Attach the base transceiver to your PC using the cable supplied. Attach the base unit antenna. Apply power to the base through the black Kobiconn DC connector using the accompanying adapter. The base LEDs should all be red.

Flip the toggle switch on the Riverboat to turn on the power. (Confirm power to your instruments- is your battery charged?)

Shortly after both units are powered up they should establish a communications link with each other to complete the connection. Refer to Table SL-1 below to confirm that a proper link has been established. This table is also printed on both transceivers. (In this initial test condition, with ADCP and both transceivers powered up and the laptop off, transceiver LEDs should conform to line two on the table "link established, remote sending data".)

Table SL-1

Status	Remote Transceiver			Base Transceiver		
	LED 1	LED 2	LED 3	LED 1	LED 2	LED 3
Power On, No Link	SR	SD	SR	SR	O	BR
Link Established, Remote sending data	SG	IF	IF	SG	IF	IF
Link Established, Remote sending data	SG	SR	SR	SG	SD	SR
Link Established, Base sending data	SG	SD	SR	SG	SR	SR
Setup Mode	SG	SG	SG	SG	SG	SG

Legend:
BR Blinking Red
IF Intermittent Flash Red
O Off
SD Solid Red, Dim
SG Solid Green
SR Solid Red, Bright

WinRiver Setup

Start the base PC and the corresponding application software.

Open your *Acquire* version of WinRiver. Go to s*ettings* and open the heading *communications*. Click *add*, then Broad Band ADCP, then Next. You will be asked "*on which port is it attached?*" Port identification may be different for each laptop so make sure the correct port is chosen. Once you have chosen a port and clicked *next*, you will be prompted for the baud rate. Select the same baud rate that is being used by the HydroLink transceivers and ADCP. Set *parity* at *none* and *stop bits* at *1*. Click *next* and be prepared to wait a few seconds. The *general* screen should appear with two boxes; check *use software Breaks* (===) only. Click *finish.* If you have other devices, such as a GPS or depth sounder, continue to add them using these same steps. If you have no other devices, move on to the next step.

Setup the ADCP using the *ADCP Configuration Wizard* according to USGS standard practice. Now you're ready to tryout your ADCP. First, turn the Riverboat power switch on and confirm that LED 1 on the remote transceiver is green. If it is, choose *acquire* and *start pinging* in WinRiver. The control window will appear, followed by the ADCP wakeup message and you will begin to hear a quiet pinging noise coming from your ADCP.

Congratulations! Your system is ready to begin making river discharge measurements!

Reference Information

Connections and Wiring

The HydroLink SL supports RS 232 with an 8-pin circular Micro-Change connector. The SL is designed to operate as a DTE (Data Terminal Equipment). When connecting to a DCE (Data Communication Equipment), a straight cable should be used. When connecting to another DTE, a crossover serial cable must be used. The crossover cable must have TD and RD crossed (pins 2-3 and 3-2).

The Base Transceiver should be connected to the computer. The Remote Transceiver should be connected to the instruments. Transceivers are provided as a matched pair that communicates only with each other. Each unit of the pair (set) is programmed with a unique serial number I.D.

When using the cables provided by The Oceanscience Group, note that the 8-pin circular connector is keyed and will not align in any way except in the correct alignment. Once the keyway is properly aligned, the backshell of the connector should be screwed to finger tightness. This connector is IP68 rated when properly connected.

The antenna connector is type SMA and care should be given so as to not cross-thread the connector. Again, finger tight is adequate when threading on the antenna cable.

Power Requirements

The HydroLink SL series transceiver should be powered from a 'clean' DC power source. Input voltage range must be between 10V and 14V.

Power source should be capable of supplying a peak current of 1.0 Amp.

Power cable to the transceiver should be routed away from the antenna. Close proximity between the two may result interference.

Transceiver input power is reverse-polarity protected.

Antennae Requirements

When purchased as part of The Oceanscience Group Riverboat System, the remote (boat) transceiver utilizes a rugged 2.4GHz/900MHz antenna, while the base unit comes equipped with an omni-directional antenna. All antennae, their connectors and cables have 50ohms of impedance. Using other antennae, connectors, or cabling could result in unsatisfactory results.

Placement of your HydroLink SL base unit is likely to have a significant impact on its performance. Generally, the higher the placement of the antenna the better the communications link - height is everything! In practice you should also place the transceiver away from computers, telephones, answering machines, and other similar equipment. To improve the data link, Oceanscience offers directional and omnidirectional antennas with cable lengths ranging from 3 to 200 feet and of varying gain.

When using an external antenna, placement of that antenna is critical to a solid data link. Other antennas in close proximity are a potential source of interference. It is also possible that slight adjustments in antenna placement (as little as 2 feet) will solve noise problems. In extreme cases, such as when the transceiver is located close to pager or cellular telephone transmission towers, Oceanscience can offer band pass filters (a standard filter and a cavity filter) to reduce the out of band noise.

RS232 Interface

Because the transceivers' serial data parameters are fixed, instruments and any related application PC software must be set to match. **The serial data rate for the HydroLink SL is 115,200.**

When configuring the instrument and application software to match the transceiver, the PC and instrument should be connected directly.

Do not attempt to change instrument settings using the transceivers. Communication is not possible until the instrument and application software settings match those of the transceivers. Some instruments transmit or receive control pulses using the computer RS232 com port. Because the transceivers transfer binary data, with a pre-defined data byte length, attempting to send control pulses using the transceivers is not recommended. A specific example of this is the "wake-up" or break command used by some ADCP manufacturers. The standard "wake-up" command is a 300 ms pulse sent from the computer comm port to the ADCP. If this pulse is routed through the transceivers, it will not be recognized by the ADCP. The solution to this format conflict is to use the ADCP alternate "wake-up" command of three ASCII equals signs" = = = ". Using this alternate control command maintains the binary data format and will be recognized by the ADCP through the transceivers. All instrumentation connected to the transmit and receive data lines of the transceiver should be verified to use RS-232 format.

Troubleshooting

This section lists some problems that you might encounter while using your HydroLink ML2 transceiver:

Symptom	Possible solution
I cannot connect.	• Make sure that you have connected power to your transceivers. The LED indicator should emit a green light when powered up, being ready to send and receive data then turning blue.
	• Your remote instrument is not configured to use the same serial settings (e.g. baud rate) as your HydroLink SL.
	• Your transceivers are too far away from each other. Move them closer or raise the base antenna.
	• Check all cabling connections.
The link between my transceivers disconnects.	• There is substantial interference.
	• Your transceivers are too far away from each other. Move the two devices closer to each other or raise the base antenna. • Your battery voltage is low.
There is no color on the LED indicator.	• Make sure that power is connected to the device by checking: data/power circular connector on HydroLink face, quick-disconnects, battery connections are polarity correct, Kobiconn DC adapter is connected, toggle switch is in the "on" position.
I'm receiving data but it's garbled.	• Verify the baud rate on your data instrument matches the baud rate of your HydroLink SL.
I have no power.	• Check your battery, battery connections, and fuse.

Technical Specifications

900 MHz Transceiver Specifications

Frequency	902 to 928 MHz
Transmitter Output Power	1mW to 1W (+30 dDm)
Range	*60miles
Modulation	Spread Spectrum GFSK, 120 kBs – 170 kBs
Spreading method	Frequency hopping
Occupied Bandwidth	230 kHz
System gain	140 dB
Error Detection	32 Bit CRC, resend on error
Forward error correction	Golay, retransmit on uncorrectable error
Data Encryption	Substitution, dynamic key
Max Link Throughput	115 Kbaud standard speed
Data Interface	RS-232/RS485
Operating Modes	Point-to-Point, Point-to-Multipoint, Repeater
* Line of sight distance with unity gain antenna ** Throughput measured assuming 75% frequency availability	

2.4 GHz Transceiver Specifications

Specification	
Frequency	2.400 to 2.4835 GHz
Transmitter	
Output power	0.5 mW to 500 mW (+27 dBm) See RF transmit power settings.
Range	20 miles Line Of Sight with 5dB omni antenna
Modulation	GFSK, 115.2 or 153.6 Kbps
Occupied bandwidth @ 60dB	230 kHz
Channel Spacing	346 kHz
Receiver	
Sensitivity	-107 dBm at 10-4 bit error rate -105 dBm at 10-6 bit error rate
Selectivity	-20 dB at f_c ± 115 kHz -60 dB at f_c ± 145 kHz
System gain	134 dB
Data transmission	
Error detection	32 Bit CRC, retransmit on error
Data encryption	Substitution, dynamic key
Link throughput	115.2 kbps sustained throughput* 57.6 kbps sustained throughput* with Repeaters.
Data interface	RS-232/RS485 1200 Baud to 230.4 KBaud, async, full duplex TTL (RF board level only)
Power requirements	
Supply voltage	9.5 – 30 VDC
Transmit current, for 500 mW power at 100% duty cycle	410 mA at 9.5 VDC 325 mA at 12 VDC 130 mA at 30 VDC
Receive current	140 mA at 9.5 VDC 110 mA at 12 VDC 44 mA at 30 VDC
Idle current	82 mA at 9.5 VDC 65 mA at 12 VDC 26 mA at 30 VDC
Sleep current	15.8 mA at 9.5 VDC 12.5 mA at 12 VDC 5 mA at 30 VDC
Operating modes	Point-to-Point Point to-MultiPoint
Operating environment	-40° C- +75° C, 0 to 95% humidity non-condensing

* At 100% receive success rate. RF data rate setting of 2.

Regulatory Information

FCC Identifier KNY21161341911919
DOC Identifier 2329 102 336A

FCC Notification

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: 1) This device may not cause harmful interference and 2) this device must accept any interference received, including interference that may cause undesired operation.

This device must be operated as supplied by The Oceanscience Group. Any changes or modifications made to the device without the express written approval of The Oceanscience Group may void the user's authority to operate the device.

CAUTION: The transceiver has a maximum transmitted output power of 955mW. It is recommended that the transmit antenna be kept at least 23 cm away from nearby persons to satisfy FCC RF exposure requirements.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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